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What is claimed is:

1

2

2.

substrate comprises silicon.

1	1. A method for forming bottle-shaped crenches,
2	suitable for use in a dynamic random access memory
3	(DRAM), comprising:
4	providing a substrate;
5	forming a hard mask having openings on the
6	substrate;
7	etching the substrate through the openings to form
8	trenches with a upper portion and a lower
9	portion;
LO	conformally forming a isolated layer in the trenches
11	and on the hard mask;
L2	forming a shield layer in the lower portion of the
L3	trenches;
L4	removing parts of the isolated layer which is not
L5	covered by the shield layer to expose the
16	surface of the upper portion of the trenches;
L7	forming a protective layer on the sidewall of the
L8	upper portion of the trenches;
L9	removing the shield layer to expose the isolated
20	layer in the lower portion of the trenches;
21	removing the isolated layer to expose the substrate
22	of the lower portion of the trenches; and
23	etching the substrate of the lower portion of the
24	trenches using the protective layer as a mask
25	to form bottle-shaped trenches.

The method as claimed in claim 1, wherein the

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- The method as claimed in claim 2, wherein the
 hard mask comprises a nitride.
- 1 4. The method as claimed in claim 1, wherein the trenches are etched by an anisotropic etching.
- 5. The method as claimed in claim 1, wherein the isolated layer comprises an oxide.
- 6. The method as claimed in claim 5, wherein the isolated layer is formed by chemical vapor deposition (CVD).
- 7. The method as claimed in claim 1, wherein the protective layer further comprises dopants.
- 8. The method as claimed in claim 7, wherein after forming the protective layer further comprises driving the dopants into the substrate surrounding the protective layer by thermal treatment.
- 9. The method as claimed in claim 1, wherein the shield layer comprises polysilicon.
- 10. The method as claimed in claim 8, wherein the step of forming a shield layer in the lower portion of the trenches comprises:

forming the shield layer to fill the trenches;

removing parts of the shield layer in the upper
portion of the trenches to leave parts of the
shield layer in the lower portion of the
trenches.

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The method as claimed in claim 1, wherein the 1 shield layer is formed by chemical vapor deposition 2 (CVD). 3 The method as claimed in claim 1, wherein the 12. 1 protective layer comprises a nitride. 2 The method as claimed in claim 12, wherein the 13. 1 protective layer is formed by chemical vapor deposition 2 (CVD). 3 14. A method for forming bottle-shaped trenches, 1 suitable for use in a dynamic random access memory 2 (DRAM), comprising: 3 providing a substrate; 4 forming a hard mask having openings the 5 on substrate; 6 etching the substrate through the openings to form 7 trenches with a upper portion and a lower 8 portion; 9 conformally forming a isolated layer in the trenches 10 and on the hard mask; 11 forming a shield layer in the lower portion of the 12 trenches; 13 removing parts of the isolated layer which is not 14 covered by the shield layer to expose the 15 surface of the upper portion of the trenches; 16 conformally forming a protective layer on the 17 sidewall and the bottom of the trenches; 18 removing parts of the protective layer on the bottom 19 the trenches to leave parts of the of 20

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layer on the sidewall of the 21 protective trenches; 22 removing the shield layer to expose the isolated 23 layer in the lower portion of the trenches; 24 removing the isolated layer to expose the substrate 25 of the lower portion of the trenches; and 26 27 etching the substrate of the lower portion of the trenches using the protective layer as a mask 28 29 so as to form bottle-shaped trenches.

- 1 15. The method as claimed in claim 14, wherein the substrate comprises silicon.
- 1 16. The method as claimed in claim 14, wherein the hard mask comprises a nitride.
- 17. The method as claimed in claim 14, wherein the trenches are etched by an anisotropic etching.
- 18. The method as claimed in claim 14, wherein the isolated layer comprises an oxide.
- 19. The method as claimed in claim 18, wherein the isolated layer is formed by chemical vapor deposition (CVD).
- 20. The method as claimed in claim 14, wherein the protective layer further comprises dopants.
- 21. The method as claimed in claim 20, wherein after formation of the protective layer, dopants are driven into the substrate surrounding the protective layer by thermal treatment.

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- 1 22. The method as claimed in claim 14, wherein the shield layer comprises polysilicon.
- 1 23. The method as claimed in claim 14, wherein the 2 step of forming a shield layer in the lower portion of 3 the trenches comprises:

forming the shield layer to fill the trenches;

removing parts of the shield layer in the upper

portion of the trenches to leave parts of the

shield layer in the lower portion of the

trenches.

- 24. The method as claimed in claim 14, wherein the shield layer is formed by chemical vapor deposition (CVD).
- 25. The method as claimed in claim 14, wherein the protective layer comprises a nitride.
- 26. The method as claimed in claim 25, wherein the protective layer is formed by chemical vapor deposition (CVD).